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Relation between Radial and Axial Losses in Tandem Mirrors

J. PRATT, W. HORTON, H.L. BERK, IFS, UT Austin — The tandem mirror still remains a potentially attractive magnetic confinement geometry. The absence of toroidal curvature and internal plasma parallel current gives the system strongly favorable stability. Additionally, GAMMA-10 experimental results demonstrate that sheared rotation can suppress turbulent radial losses. For an MHD stable system, we investigate the interplay between drift wave (ITG, ETG and Bohm) radial transport and axial losses. Using empirical energy confinement scaling laws from large ITER and ISS databases as upper bounds on the radial loss rates, we simulate radial transport using a transport barrier dynamics (TBD) code. Simulations are carried out for a machine of volume 212 m^3 (central cell length/radius 30 m/1.5 m) with central cell field 3 T. ITER stores 7022 MJ of energy in the toroidal magnetic field; in our tandem mirror design this energy is reduced to 954 MJ. Our simulations show that high core temperatures result in long Pastukhov loss times; drift wave radial transport dominates, except at the plasma edge, where pitch angle scattering causes losses.

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